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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/818,640	03/28/2001	Atsushi Koike	35.C15222	2483

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EXAMINER

FULLER, ERIC B

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 02/13/2002

7

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/818,640

Examiner

Eric B Fuller

Applicant(s)

KOIKE ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2001.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) 14-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 10 is objected to because of the following informalities: Examiner suggests that "a high melting point metal" or something similar should replace "a high melting metal".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 6 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 6, "the plural auxiliary electrodes" lacks antecedent basis.

In claim 8, "the high frequency electric power applied to the auxiliary electrode" lacks antecedent basis.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawasaki et al. (US 4,795,529).

The ninth embodiment of the invention taught by Kawasaki is shown in figure 18 and is taught in column 16, lines 26-68; column 17, lines 1-25; with reference to column 12, lines 40-68. This embodiment contains discharge electrodes that are used to generate plasma in a vacuum vessel equipped with gas-introduction and gas-exhaust means. The raw material gas may contain silicon (column 18, line 45). Additionally there is an auxiliary electrode, in the form of a grid, used to apply a voltage bias to the substrate. This voltage is periodically changed. It is the Examiner's position that since the auxiliary electrode is being used for the acceleration of plasma and not to ignite it, this reads on the limitation of "without causing a discharge". With respect to claim 1, Kawasaki fails to teach the use of hydrogen as one of the input gases. However, since hydrogen is commonly used to enhance etching processes, it is the position of the Examiner that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use hydrogen in the process taught by Kawasaki in order to enhance the etching portion of the method.

As to claims 2-5 and 11, since the voltage bias of Kawasaki does not generate plasma, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use voltage values below that of the plasma potential. This would be inclusive of the Applicant's ranges. Specifically to claims 5 and 11, Kawasaki changes between two voltages that are both below the plasma potential. This

reads on "a voltage lower than the potential... is applied only in a certain period in at least one cycle of the periodically changing voltage."

As to claim 6, the grid electrode of Kawasaki, which one in the art could produce as one electrode or a plurality of electrodes constructed in a grid pattern (for added control of the electric field), is positioned in the flow of material gas.

As to claim 7, the discharge electrodes are supplied by a radio frequency power source. The frequency used is 13.56 MHz.

As to claims 9 and 10, to make the auxiliary electrode(s) out of a small diameter bar, such that it has no edges, would have been obvious at the time the invention was made to a person having ordinary skill in the art so that the electrode would not restrict the flow of material gas flowing over it. It would have additionally been obvious to make the electrode out of a high strength and high melting point metal, as the temperature of the plasma would be high.

Claims 1-5, 7, 8, and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goto et al. (US 5,980,999) in view of Kadomura et al. (US 5,662,819).

Goto teaches a vacuum chamber equipped with a gas inlet and exhaust port (column 4, lines 20-30). Silane gas is supplied to the vessel along with hydrogen in the form of radicals (column 7, lines 45-60). Plasma is generated by a high frequency power (RF wave) being applied to parallel plate electrodes (column 4, lines 40-45). A lower electrode connected to a high frequency power source and is used to apply a

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positive voltage bias to the substrate (column 5, lines 55-60). As this electrode only produces a bias and does not produce plasma, it is the Examiner's position that this reads on the limitation of "without causing a discharge". As to claim 13, since the voltage bias is positive, it would be inherent that only the electrons and not the ions of the radicals are energized. As to claims 1 and 13, the only limitation the reference fails to teach is to periodically adjust the voltage bias of the lower electrode.

Kadomura teaches that periodically adjusting the flow of electrons over the substrate achieves better processing performance (column 4, lines 23-42; abstract). Therefore, to adjust the flow of the electrons over the substrate by periodically adjusting the positive voltage bias would have been obvious at the time the invention was made to a person having ordinary skill in the art in order to achieve better processing performance.

As to claims 2-5 and 11, since the voltage bias of Goto does not generate plasma, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to use voltage values below that of the plasma potential. This would be inclusive of the Applicant's ranges.

As to claims 7, 8, and 12, the high frequency power supply for the lower electrodes and the discharge electrodes has a frequency of 13.56 MHz (column 8, lines 29-38).

Claims 1-5, 8, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shufflebotham et al. (US 6,106,678).

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Shufflebotham teaches a vacuum vessel equipped with inlet and exhaust means. A silicon element and a hydrogen gas are supplied to the chamber (column 5, line 47). An electrode is buried in the substrate holder and is powered by an RF current of 13.56 MHz (column 4, lines 40-65). This causes a voltage bias to be applied to the substrate. The reference also teaches the effects of changing the RF bias (column 10, lines 20-30) and specifically teaches that the Si element in the deposited layer is dependant on the RF bias applied. Therefore, it would have been obvious at the time the invention was made to a person having ordinary skill in the art to periodically adjust the RF bias applied to the substrate in order to control the amount of Si deposited. This reference teaches that the plasma is generated by microwave and fails to teach that electrodes generate the plasma. However, to use either method of generating plasma would have been obvious at the time the invention was made to a person having ordinary skill in the art with the expectation of similar results.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Asamaki et al. (US 4,950,956) teaches a chamber that has a cylindrical auxiliary electrode. Morrison, Jr. (US 4,361,472), Le Jeune (US 4,873,445), and Saito et al. (US 5,563,075) are also cited as pertinent art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B Fuller whose telephone number is (703) 308-6544. The examiner can normally be reached on Tuesday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-5408 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



EBF
February 4, 2002



TIMOTHY MEEKS
PRIMARY EXAMINER